Probability

Variable :

- Chance of occurrence .
- Ex: rolling a die, tossing a coin

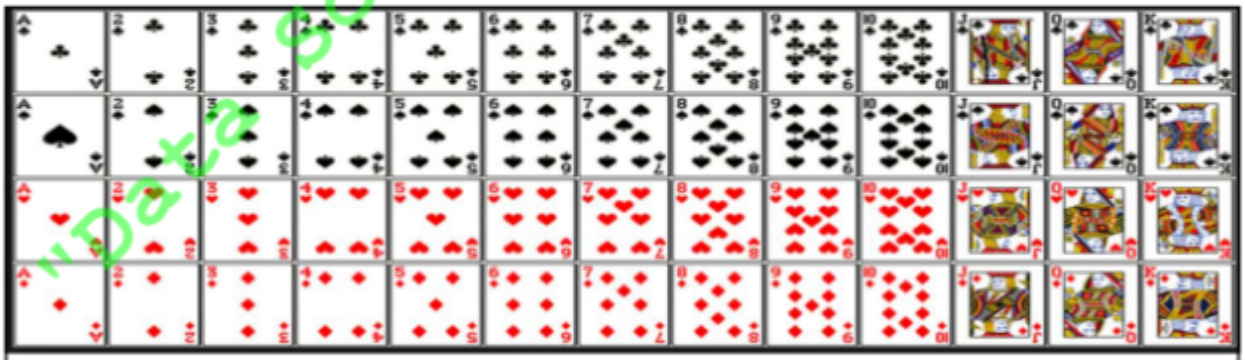
Random Variable:

A random variable is probability associated each possibility of variable .

It is a random because there is some chance associated with each possible value.

Probability = No. of interested events/total no. of outcomes

- Always probability value lies between 0 to1.
- Sum of all Probabilities =1



Suppose you have randomly picked a card from the card deck. What is the probability that this card will be?

- Bigger than 10?
- Equal to or Bigger than 10?
- Smaller than 3
- Greater than 4 and less than 8

If A & B are two independent events

P(A & B) = P(A) * P(B)

Ex: probability of getting Red & 9

P(A or B) = P(A) + P(B) – P(A & B)

Ex: probability of getting Red or 9

COVARIANCE

$$COV(x,y) = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{n-1}$$

CORRELATON

$$\rho_{X,Y} = \frac{\operatorname{cov}(X,Y)}{\sigma_X \sigma_Y}$$

where:

- cov is the covariance
- σ_X is the standard deviation of X
- σ_Y is the standard deviation of Y

CORRELATON

$$r = \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum (x_i - \bar{x})^2 \sum (y_i - \bar{y})^2}}$$

r = correlation coefficient
x_i = values of the x-variable in a sample
$\bar{x}$ = mean of the values of the x-variable
y_i = values of the y-variable in a sample
$\bar{y}$ = mean of the values of the y-variable

Range	Strength of association
0	No association
0 to ±0.25	Negligible association
±0.25 to ±0.50	Weak association
±0.50 to ±0.75	Moderate association
±0.75 to ±1	Very strong association
±1	Perfect association

OUTLIER

A DATA VALUE THAT IS NUMERICALLY DISTANT FROM A DATA SET

OUTLIER

A DATA VALUE THAT IS NUMERICALLY DISTANT FROM A DATA SET

THE MEAN IS AFFECTED BY THE PRESENCE OF OUTLIERS

A DATA VALUE IS CONSIDERED TO BE AN OUTLIER IF..

DATA VALUE < Q1 – 1.5(IQR)

OR

DATA VALUE > Q3 + 1.5(IQR)

FIVE NUMBER SUMMARY

10 25 33 36 59

10 11 12 25 25 27 31 33 34 34 35 36 43 50 59

A DATA VALUE IS AN OUTLIER IF IT IS

LESS THAN 8.5

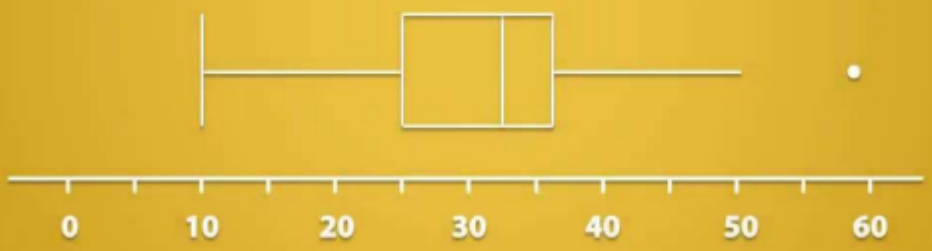
GREATER THAN 52.5

IQR = 11

FIVE NUMBER SUMMARY

10 25 33 36 59

10 11 12 25 25 27 31 33 34 34 35 36 43 50 59

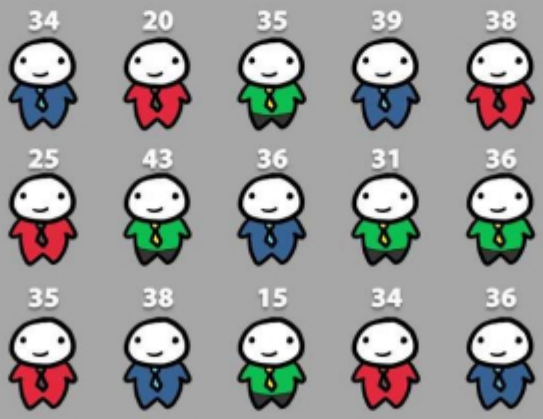


WHAT'S A PERCENTILE?

DESCRIBES THE PERCENTAGE OF DATA VALUES THAT FALL AT OR BELOW ANOTHER DATA VALUE

CLASS SIZE
n = 15

(SCORE OUT OF 50)



50th percentile

50% OF THE DATA POINTS ARE AS SMALL OR SMALLER

Percentiles: Computational Procedure

- Organize the data into an ascending ordered array
- Calculate the p th percentile location:

$$i = \frac{P}{100}(n)$$

- Determine the percentile's location and its value.
- If i is a whole number, the percentile is the average of the values at the i and (i+1) positions
- If i is not a whole number, the percentile is at the (i+1) position in the ordered array

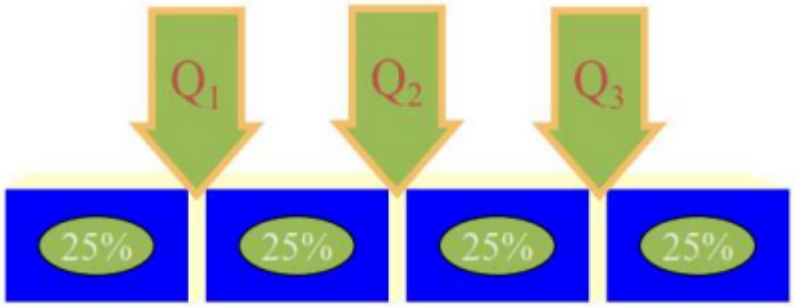
Percentiles: Example

- Raw Data: 14, 12, 19, 23, 5, 13, 28, 17
- Ordered Array: 5, 12, 13, 14, 17, 19, 23, 28
- Location of 30th percentile:

$$i = \frac{30}{100}(8) = 2.4$$

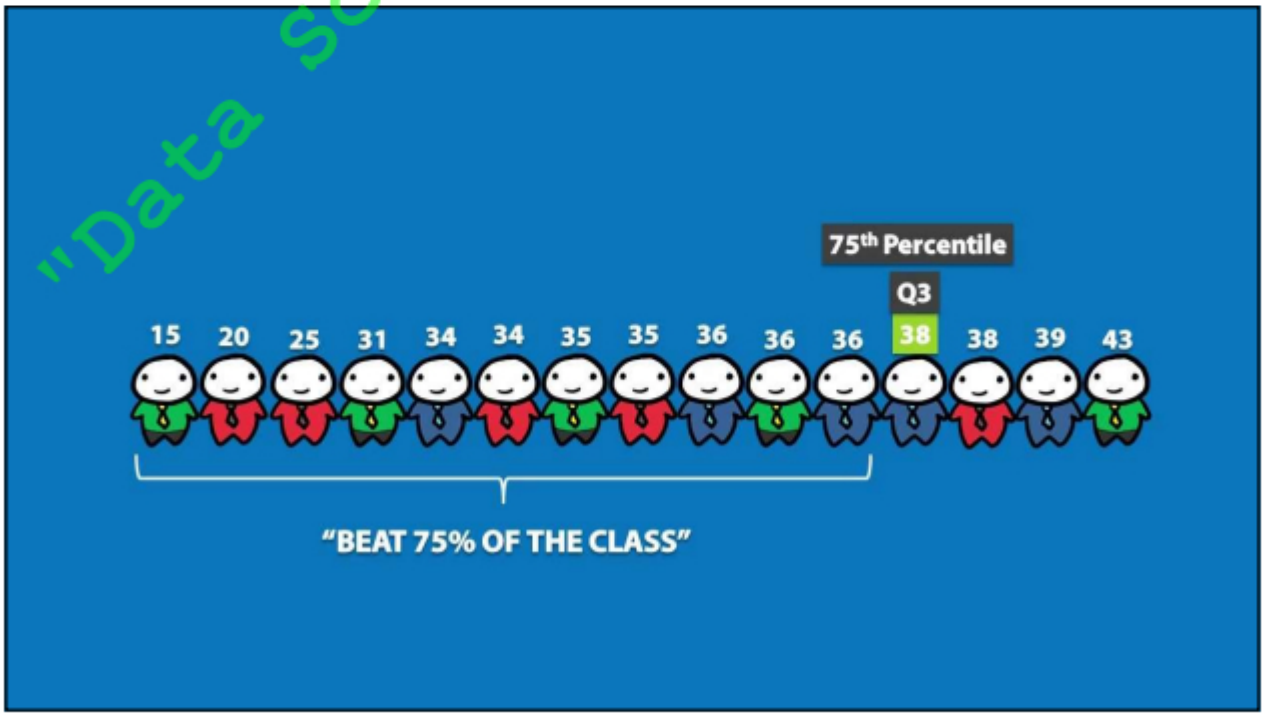
- The location index, i, is not a whole number; i+1 = 2.4+1=3.4; the whole number portion is 3; the 30th percentile is at the 3rd location of the array; the 30th percentile is 13.

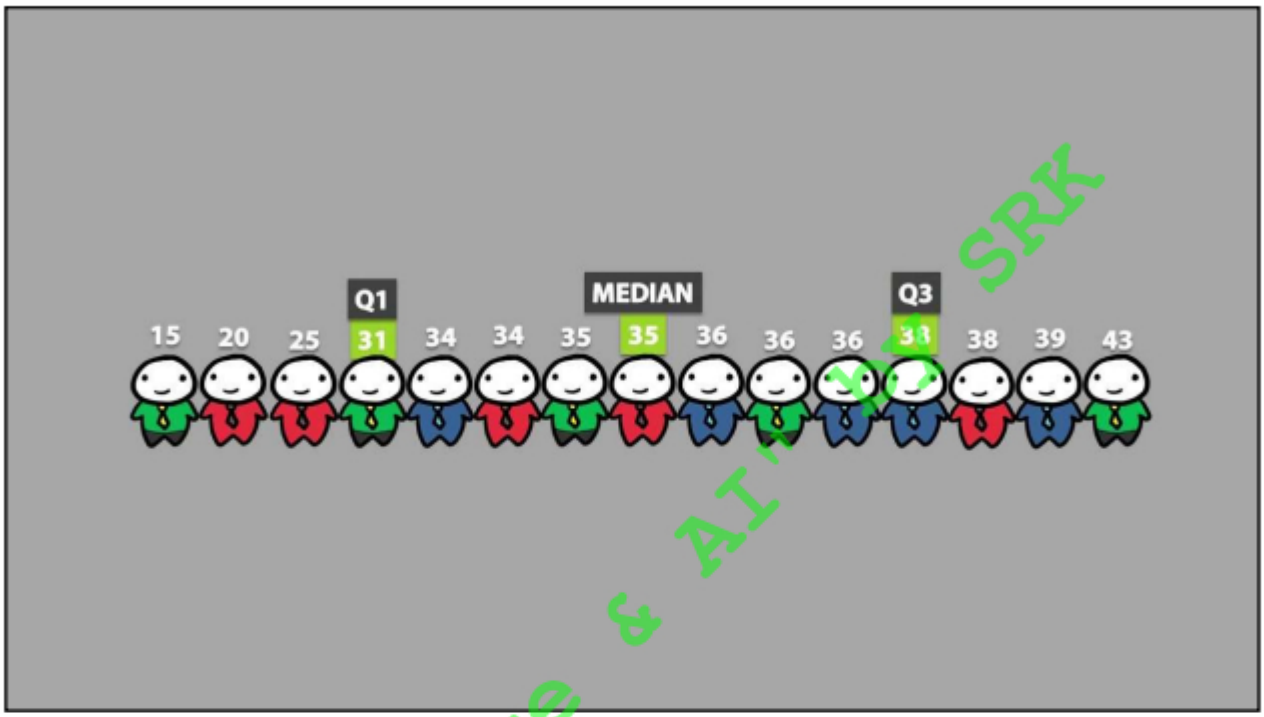
Quartiles



Quartiles

- Measures of central tendency that divide a group of data into four subgroups
- Q_1: 25% of the data set is below the first quartile
- Q_2: 50% of the data set is below the second quartile
- Q_3: 75% of the data set is below the third quartile
- Q_1 is equal to the 25th percentile
- Q_2 is located at 50th percentile and equals the median
- Q_3 is equal to the 75th percentile
- Quartile values are not necessarily members of the data set





Quartiles: Example

- Ordered array: 106, 109, 114, 116, 121, 122, 125, 129
- Q_1

$$i = \frac{25}{100}(8) = 2 \qquad Q_1 = \frac{109+114}{2} = 111.5$$

- Q_2:

$$i = \frac{50}{100}(8) = 4 \qquad Q_2 = \frac{116+121}{2} = 118.5$$

- Q_3:

$$i = \frac{75}{100}(8) = 6 \qquad Q_3 = \frac{122+125}{2} = 123.5$$

Interquartile Range

- Range of values between the first and third quartiles
- Range of the "middle half"
- Less influenced by extremes

$$Interquartile\ Range = Q_3 - Q_1$$

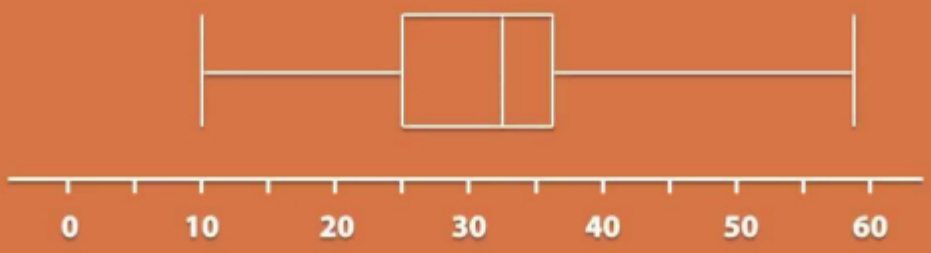
FIVE NUMBER SUMMARY

MINIMUM	1ST QUARTILE	MEDIAN	3RD QUARTILE	MAXIMUM
10	25	33	36	59

BOXPLOT

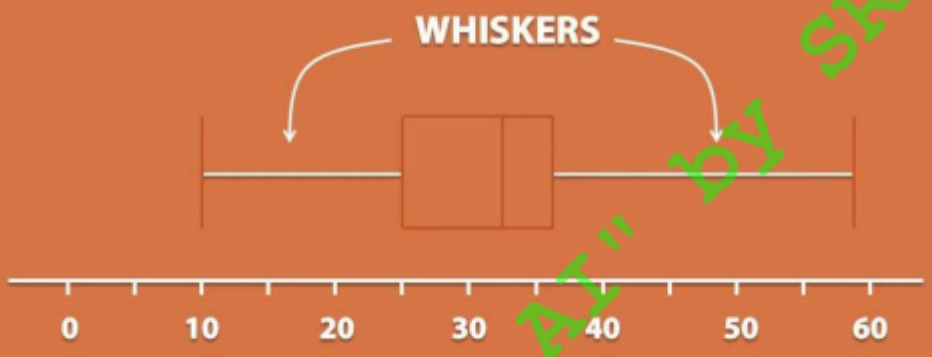
GIVES US A VISUAL REPRESENTATION OF THE FIVE NUMBER SUMMARY

10 25 33 36 59

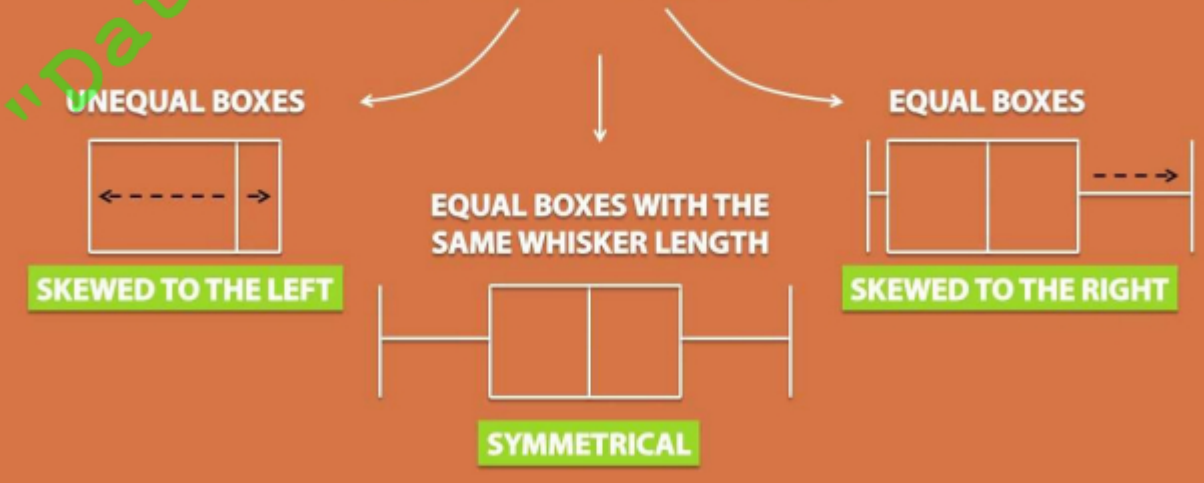


BOXPLOT

GIVES US A VISUAL REPRESENTATION OF THE FIVE NUMBER SUMMARY



STRATEGIES FOR DETERMINING THE SKEWNESS FOR A BOXPLOT



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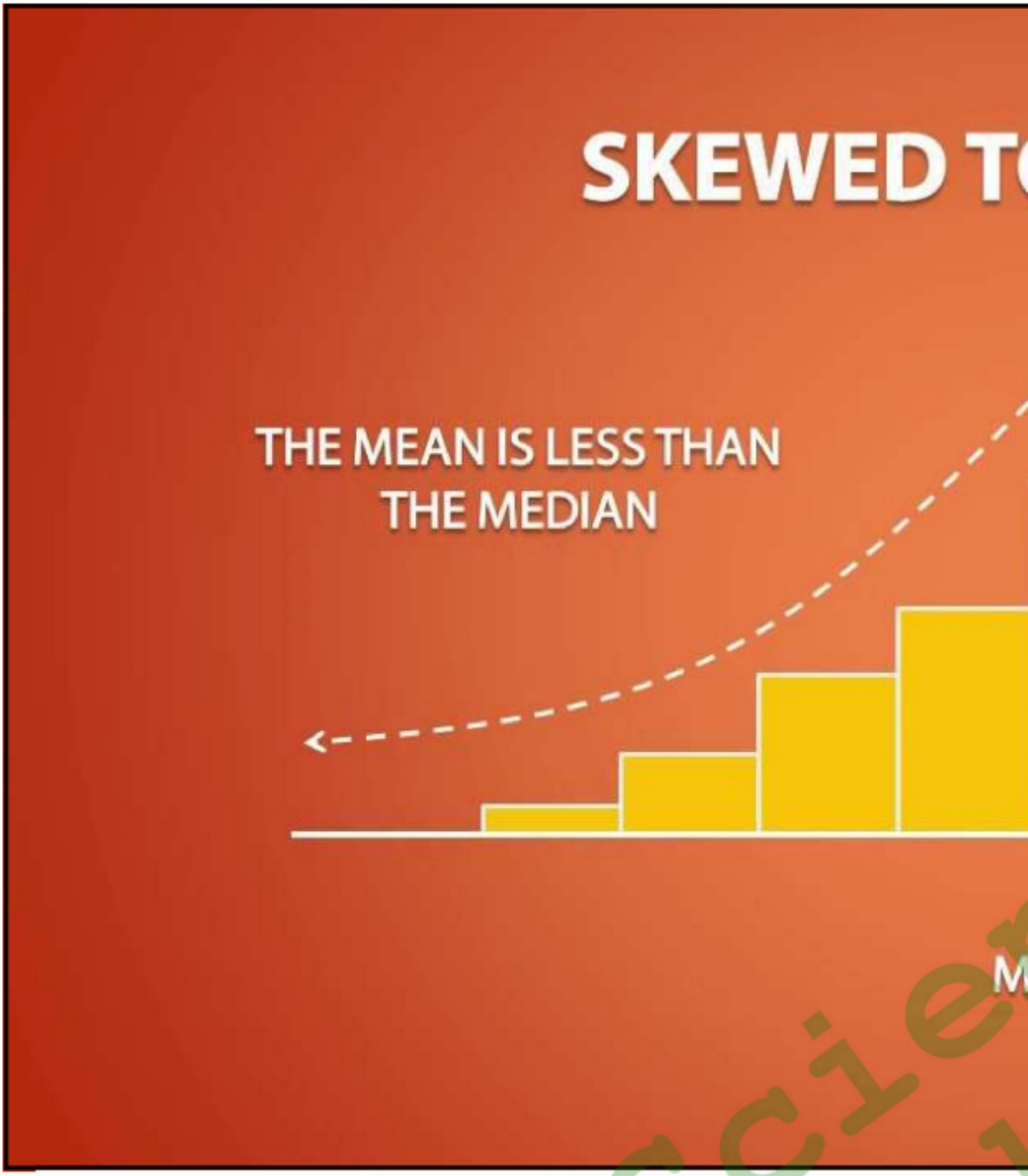
DISTRIBUTION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THE MEAN IS LESS THAN
THE MEDIAN
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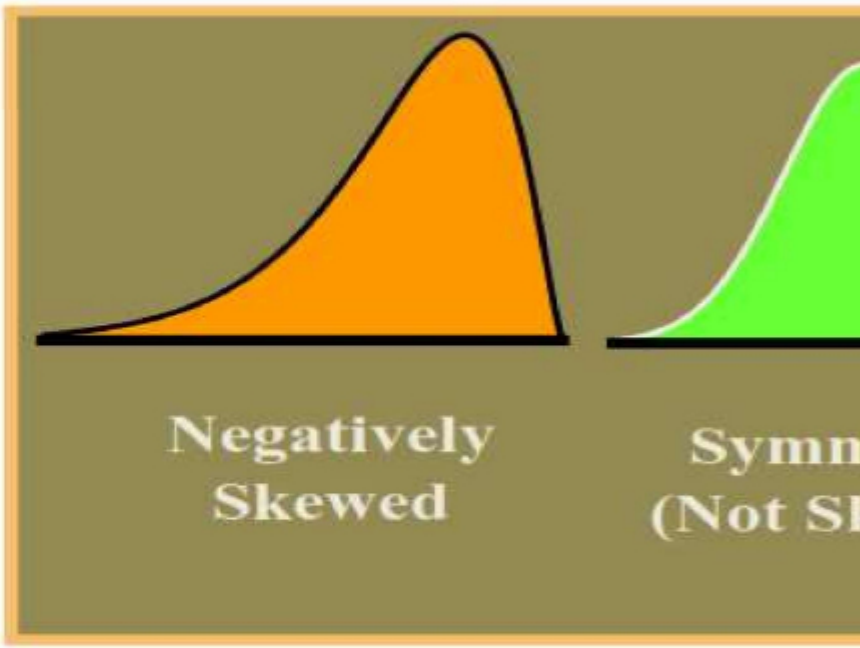
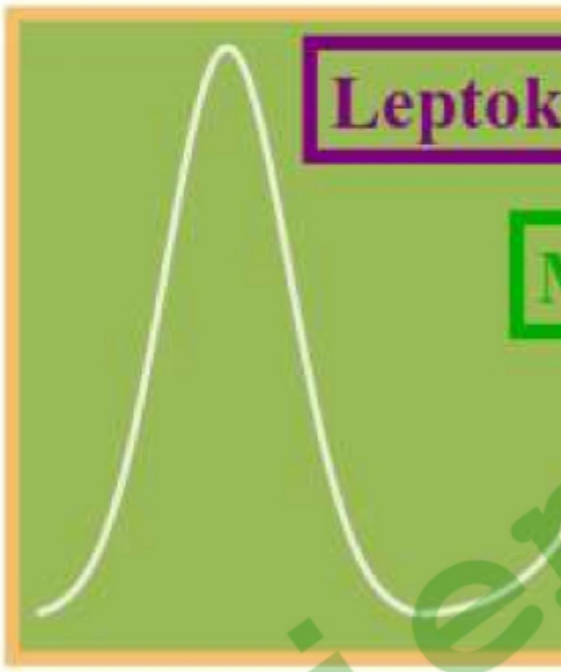
Skew



- If S < 0, the distribution is negativ
- If S = 0, the distribution is symme
- If S > 0, the distribution is positive

Kurt

- Peakedness of a distribution
  - Leptokurtic: high and thin
  - Mesokurtic: normal in shape
  - Platykurtic: flat and spread out



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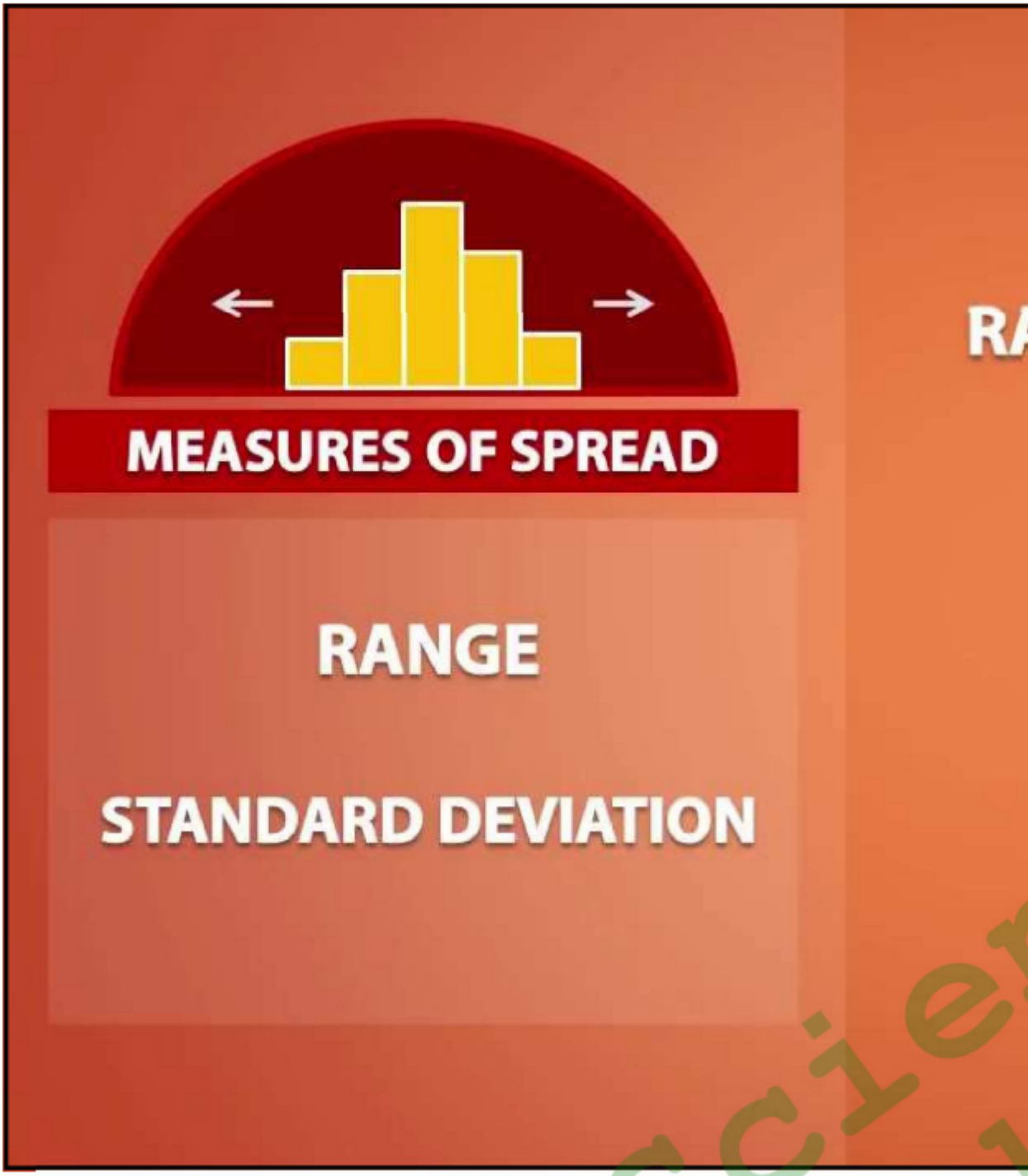
MEASURES OF SPREAD
RANGE
STANDARD DEVIATION

Mean Abso

- Average of the absolute deviation

X	$X - \mu$	$\lvert X - \mu \rvert$
5	-8	+8
9	-4	+4
16	+3	+3
17	+4	+4
18	+5	+5
	0	24

Population Stand

- Square root of the variance

X	$X - \mu$	$(X - \mu)^2$
5	-8	64
9	-4	16
16	+3	9
17	+4	16
18	+5	25
	0	130

Sample

- Average of the squared deviations

X	$X - \overline{X}$	$(X - \overline{X}$
2,398	625	390,6
1,844	71	5,0
1,539	-234	54,7
1,311	-462	213,4
7,092	0	663,8


STANDARD
HOW CLOSE TH
ARE TO THE ME


STANDARD
HOW CLOSE TH
ARE TO THE ME
MEA
HIGH

Coefficient o

$$\mu_1 = 29$$

$$\sigma_1 = 4.6$$

$$C.V_{.1} = \frac{\sigma_1}{\mu_1}(100)$$

$$= \frac{4.6}{29}(100)$$

$$= 15.86$$